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# Friendly Fire: The Price of War

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Thesis: Although there are no absolute solutions, the Department of Defense can significantly reduce fratricide by modifying current doctrine and incorporating emerging technologies. This paper addresses situational awareness, target identification and technology related issues.

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# FRIENDLY FIRE: THE PRICE OF WAR

Submitted to
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**FRIENDLY FIRE: THE PRICE OF WAR**

**OUTLINE**

**THESIS STATEMENT:** Although there are no absolute solutions, the Department of Defense can significantly reduce fratricide by modifying current doctrine and incorporating emerging technologies.

I. **HISTORICAL BACKGROUND**

- A. Addressing the magnitude of friendly fire.
- B. Looking at fratricide statistics from Southwest Asia.

II. **SITUATIONAL AWARENESS**

- A. Examining the shortfalls of situational awareness.
- B. Methods to improve situational awareness.

III. **DOCTRINAL AND PROCEDURAL SHORTFALLS**

- A. Discussion of interservice doctrine.
- B. Performing risk assessments to reduce fratricide.

IV. **TECHNOLOGY AND COMBAT IDENTIFICATION**

- A. Assigning responsibilities to the military services.
- B. Quick-Fix as an interim answer to the fratricide problem.
- C. Quick-Fix Plus addresses friendly fire preventive technology for the next three to five years.
- D. Possible near and far term solutions.

V. **SUMMARY**

## Friendly Fire: The Price of War

### INTRODUCTION

Solutions to the problem of killing and wounding of friendly forces, better known as fratricide, have been sought since the existence of armed conflict. Although there are no absolute solutions, fratricide can be significantly reduced by modifying current doctrine and incorporating emerging technologies. As long as human beings wage warfare, human error will result in the inadvertent killing of friendly forces. However, as leaders we are obligated to explore avenues that will decrease the number of fratricide victims. During Operation Desert Shield a joint Combat Identification task force was formed in the United States. After much debate and exhaustive study, this task-force decided that developing greater battlefield situational awareness and improved target identification would help reduce the incidence of fratricide. Additional evidence indicates that the friendly fire problem is being attacked on two fronts by Department of Defense (DoD) agencies. First, doctrine and procedures are being evaluated for their relevance on the modern battlefield. Next, technology is being exploited to compensate for the range and lethality of current, state-of-the-art weapons systems.

In order to better understand the importance of developing doctrine, procedures, and technology in combatting the friendly fire problem, we must take an historical look at fratricide.

**HISTORICAL BACKGROUND**

Friendly fire casualties have been a product of armed conflict since warfare began. Friendly fire incidents have been documented among the armies of antiquity, as well as those of modern times. Yet, the magnitude of the problem is impossible to determine due to the inadequate collection of data through the ages. Commanders, reluctant or unable to report fratricide incidents, may have erroneously omitted statistics from after-action reports and official histories. Dr. Charles R. Schrader, a retired Army lieutenant colonel has studied friendly fire extensivley. He published a study in 1982 when he was a student at the U. S. Army Command and General Staff College. As Dr. Schrader detailed his theory for possible inadequacies in reporting in his 1982 study *Amicicide: The Problem of Friendly Fire in Modern War:*

> The disarray of source materials for the study of amicicide is understandable. The conditions of active combat in which cases of amicicide occur are

> scarcely conducive to thorough, accurate reporting of what at the time may seem relatively minor incidents. Furthermore, commanders at various levels may be reluctant to report instances of casualties due to friendly fire either because they are afraid of damaging unit or personal reputations, because they have a misplaced concern for the morale of surviving troops or the benefits and honors due the dead and wounded, or simply because of a desire to avoid unprofitable conflicts with the personnel of supporting or adjacent units. In many cases, of course, the victim's commander may never know that a particular casualty was due to friendly fire. (15:52)

Various sources have produced fratricide casualty estimates for U. S. forces spanning the two World Wars, the Korean War, and the Vietnam War. The number of American fratricide casualties in twentieth century warfare has been estimated to range from just under 2% to about 25% of all service members killed in action (KIA). Regardless of which figure is most accurate, one incontrovertible fact remains-friendly fire has tragic results. Besides reducing combat power, fratricide demoralizes our troops and leaders, and jeopardizes successful mission completion.

U. S. military investigations after Operation Desert

Storm were probably the most thorough and accurate in the history of modern American warfare. In a news release published by the Office of Assistant Secretary of Defense, investigators concluded that 28 friendly fire incidents occurred during the Gulf War. These incidents resulted in 35 of the 148 total KIAs, while friendly fire wounded 72 of the 467 service personnel classified as wounded in action (WIA). The 28 friendly fire incidents investigated are divided into five categories of engagements: ground-to-ground, air-to-ground, ship-to-ship, shore-to-ship and ground-to-air. Ground-to-ground engagements were the most prevalent and the most lethal in terms of killed and wounded. 16 ground-to-ground and air-to-ground engagements resulted in the death of 24 soldiers and Marines. 57 others were wounded in these encounters.

**SITUATIONAL AWARENESS**

In the "fog of war," engagements must be authorized based not only on a leader's years of experience, but also on the information that is received from subordinates on the front lines. Looking from this perspective a sense of situational awareness must be instilled in all personnel then reinforced through training. Identifying the problems

that cause loss or lack of current situational awareness on the battlefield is the first step. Unfamiliar or unrecognizable terrain is a problem. Not knowing the capabilities and identities of flanking units is another. However, not knowing the future plans of those flanking units is probably the greatest problem of all. Lack of situational awareness can lead to a fratricide incident if any of these problems are left unresolved. To remedy these shortfalls we must do two things: increase situational awareness at all levels and modify our current doctrine, fire control procedures, and rules of engagement to match our maneuver warfare tactics.

To increase situational awareness, leaders must, according to a U. S. Army study, ensure that every member of an organization has "the real-time accurate knowledge of one's own location [and orientation], as well as the locations of other friendly, enemy, neutrals, and noncombatants. This includes the awareness of the of Mission, Enemy, Terrain, Troops and equipment, and Time (METT-T) conditions that impact on the operation." (9:5) All available information must be efficiently and accurately disseminated throughout an organization. Reinforcing learned techniques such as land navigation and fire support planning (direct and indirect) is crucial.

Plans that require movement need to be simple. These

plans also need to tie control measures to easily identifiable terrain features. If navigation aids such as Position Location Reporting System (PLRS) or Global Positioning System (GPS) equipment are used, ensure that personnel are well trained in their use. Basic navigational skills must be maintained in case this equipment fails. Insist on timely reporting and then passing of information, as appropriate, both laterally and up and down the chain of command. Most importantly, all routes, control measures, and fire support plans must be clearly understood by all members of a unit to guarantee situational awareness. By integrating these control measures in all aspects of training, commanders can greatly increase the overall situational awareness within their unit.

**DOCTRINAL AND PROCEDURAL SHORTFALLS**

Doctrinal and procedural differences that exist between U. S. military forces are significant causes of friendly fire. These problems are caused by service parochialism and lack of joint training. For example, differences in operational syntax continue to plague communications throughout the services in spite of distribution of Joint Chiefs of Staff Publication 1, which

created a uniform operational terminology. Another example is lack of inter-service doctrine combined with general unfamiliarity between services. This is likely to be the single largest contributor to our inadequate fire control measures. Existing fire control measures and rules of engagement have not been modified to keep pace with the capabilities inherent in our current weapons systems or our warfare tactics.

Changing our doctrine to match our current organization for combat, weapons systems, and tactics is necessary if we want to reduce fratricide. If we intend to fight in a joint or combined forces environment, liaison teams with trained linguists are a must. These liaison teams should also include operators representing all supporting arms. The staff of any joint/combined task force commander needs to have an organic subsection or directorate that has the overall responsibility for supporting arms planning and coordination within the task force. This subsection would further solidify the lines of communication between the ground combat and air combat components of the task force; it would be similar to the Force Fires Coordination Center utilized by I MEF in Operation Desert Shield/Desert Storm.

Current tactics and rules of engagement must conform to the weapons systems' target recognition capabilities

under both optimal and degraded conditions. Modern weapon systems can engage targets at distances beyond the onboard target identification systems. Until improvements are made to the thermal sights on many weapons systems, new engagement criteria needs to be established. By fine tuning our rules of engagement we can reduce the threat of fratricide and not detract from our ability to provide decisive fires at a given time and place. Positive identification of targets or potential targets prior to engagement is essential to curb occurrences of fratricide.

To address these same problems, the Department of the Army has instituted a fratricide risk assessment program to help commanders identify the fratricide risk inherent in a particular operation or exercise. This program stresses that the level of potential for fratricide can be ascertained by reviewing various aspects at certain phases of an operation. This allows the commander to make the operation as safe as possible without compromising the integrity of the mission. Commanders should use the factors depicted in Figure (1) as a basis for identifying potential problem areas.

It should be noted that these areas are only starting points from which to begin a fratricide risk assessment. Any factors that are unique to a given situation should also considered. Procedures can be developed with

PLANNING PHASE

Clarity of enemy intent.

Clarity of friendly intent.

Clarity of commander's intent.

Complexity of operations.

Rules of engagement.

Allocation of subordinate planning time.

PREPARATION PHASE

Rehearsals.

Training\proficiency of unit.

Relationship between participating units.

Endurance of unit.

EXECUTION PHASE

Intervisibility between units.

Battlefield obscuration.

Target acquisition vs target identification.

Friendly and enemy equipment similarities and dissimilartities.

Vehicular density of battlefield.

Tempo of battle.

FIGURE (1)



provides locations of friendly forces. Therefore,

fratricide prevention already taken into consideration in both the deliberate and hasty planning phases. This process is accomplished in two stepsduring planning. The first step is analyzing the individual factors' effects for potential to contribute to or precipitate into a friendly fire incident. The next step is comparing these factors to the METT-T, troop leading procedures, and courses of action. This process will carry over into preparation and execution phases through supervision by the commander, his staff, and the subordinate commanders. The entire process is illustrated in Figure (2). (9:B-2)

| FRATRICIDE Risk Reduction Measures | Routine Measures Low Risk | Caution | Extraordinary Measures High Risk |
|---|---|---|---|
| • FIRE AND MANEUVER CONTROL | Brief Backs<br>Supervision<br>PMCS & Pre Combat Checks | Lim Vis Rehearsal<br>Reinforce Clear Intent<br>Cross-Level/Consolidate Equip | Converging/Adj Forces Rehearsa<br>Task Force Rehearsa |
| • FIRE DISTRIBUTION PLAN | Extensive Rehearsals<br>SOPs<br>Synchronization Matrix | Modify Task Organization<br>Some Direct Fire Units-Wpns Hold or Tight<br>Limited Visibility Plan | Multiple Synchron zat n Rehearsa s<br>Modify Plan<br>Limited Objectives |
| • LAND NAVIGATION | Detailed Navigation Plan<br>Reconnaissance Confirms Impact of Terrain-Weather-Enemy | Ground Guides/Night Vision Aids<br>Redundant Navigation Aids<br>Marking Enemy Positions | Multi-Echelon Navigation<br>Extensive Recon/Centralization<br>Reduce Equipment Dependence |
| • FIRE CONTROL AND BATTLE TRACKING | Positive Clearance of Fires<br>Commo Checks<br>Fire Support Rehearsal | Positive Clearance of Fires<br>Restrictive Control Measures<br>SOP Guides/Beacons/Vectoring | POSITIVE Clearance of Fires<br>More Leaders Forward<br>Redundant Commo<br>Provide Backups |
| • BATTLEFIELD HAZARDS | Safety Discipline<br>Disseminate Known Hazards | Vehicle Hazards Considered<br>Rehearse React to Hazard<br>Review Equip Limitations | Add Intermediate Objectives<br>Special Log/Maint Actions<br>Detailed Deception |
| • COMBAT IDENTIFICATION | Sustain CVI Skills<br>Boresight<br>Cbt Vehicle Recognition Sys | CBT ID Enhancements<br>IFF Expedients for Exposed Elements | Clear IR Friendly Marking<br>Multiple Recognition Signals |
| • FIRE CONTROL DISCIPLINE | Review ROE<br>Challenge/Password Discipline<br>Inspections<br>Buddy System | Lighten Load/Review Equip List<br>Simplified Plan<br>Simplicity/Repetition<br>Modify ROE | Interim Halts/Assessments<br>Challenge/Password Enhancements<br>Rotate High Stress Positions |
| • SOLDIER AND LEADER PREPARED-NESS | Address Seasonal Hazards<br>Sustainment Training<br>Sustain Morale<br>Full Troop Leading Process<br>Sleep Plan | Max Use of Transport<br>Abbreviated Troop Leading Process<br>Refresh Mission Specific Skills<br>Controlled Pace in Execution | Priority of Tasks<br>Priority of Rehearsals<br>FRAGO only for Efficiency<br>Request Additional Combat Power<br>Don't Exceed Tng Proficiency |

FIGURE (2)



their allies find themselves involved in the next armed

| FRATRICIDE Risk Reduction Measures | Routine Measures → Low Risk | Caution | Extraordinary Measures High Risk |
|---|---|---|---|
| • FIRE AND MANEUVER CONTROL | Brief Backs<br>Supervision<br>PMCS & Pre Combat Checks | Lim Vis Rehearsal<br>Reinforce Clear Intent<br>Cross-Level/Consolidate Equip | Converging/Adj Forces Rehearsal<br>Task Force Rehearsa |
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FIGURE (2)



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## TECHNOLOGY AND COMBAT IDENTIFICATION

The Department of Defense is looking to industry and its advancing technology in an effort to reduce fratricide. As previously mentioned, the increased range and standoff engagement distance of new weapons systems further complicate the friendly fire problem. To improve this situation, industry must address the shortcomings in combat target identification and the need for an improved system for enhancing battlefield situational awareness. If these obstacles can be overcome, improvements in doctrine, training, and management of the new systems should greatly reduce the loss of personnel and assets to friendly fire. In attacking this problem, the Navy is preparing the Joint Management Plan and the Joint Master Plan regarding the fratricide issue. The Navy is leading the effort in Cooperative Aircraft Identification, Air-to-Air, and Ship-to-Ship anti-fratricide research. A Congressional report published October 5, 1992 states:

> The conferees agree with House language which directs the Army to take the lead for ground combat identification. In addition, the conferees direct that the Army develop ground IFF (Identification-Friend or Foe) systems for the Marine Corps. The Marine Corps is directed to

assign a senior officer to the Army program office to make sure that Marine Corps' interests are represented. (1)

The Army is the lead department for developing Air-to-Ground, Forward Anti-Air Defense Combined Arms, and Ground-to-Ground anti-fratricide methods. The Army's role as initiator is driven by the size of the service and the direct topical correlation to the other services. A task force comprised of elements from the Army's Training Command and Material Development Command has identified near, mid-term, and long-term solutions that approach the topic as either a situational awareness problem or an inability to adequately identify the targets.

The Marine Corps is also working with the Army in an effort to find solutions to these problems. Operation Desert Shield/Desert Storm, with its great potential for inordinately high percentages of friendly fire casualties, forced the Army to begin looking even harder for solutions to the fratricide problem. The Army established an Office of Combat Identification Technologies (OCIT) to develop solutions. Working with the Marine Corps and the Air Force, the OCIT was able to identify, develop, test, and field BUDD lights, DARPA lights, and thermal tape. All were used by units in Southwest Asia, although thermal tape had already been used by U. S. Army Rangers during night

raids in Panama.

In the aftermath of the Gulf War, The Army Vice Chief of Staff stated, "[the Army] cannot accept casualties that can be prevented by our own actions to improve combat identification." A March 1991 Army Acquisition Executive memorandum tasked the Army to develop possible solutions to the fratricide problem. The Army's Training and Doctrine Command and Army Material Command were assigned to find proposed solutions in the areas of doctrine, training, leader development, organization, material, and advanced technologies to interface with other services and allies.

Working groups first tried to determine the causes of friendly fire incidents. In his 1982 study, Dr. Schrader determined that friendly fire was caused by the following factors: coordination problems (45%), poor target identification (26%), inexperienced troops (19%), while the causes of the remaining 10% of incidents are unknown. A subsequent study performed by the Rand Arroyo Center in 1986 suggests three general factors contribute to direct fire fratricide: unknown location of friendly vehicles or units, intermixing of friendly and enemy vehicles on the battlefield, and misidentifying targets. These two studies highlight the battlefield target identification problem. Target misidentification, along with disorientation of the attacking unit on the battlefield; poor unit location

reporting and tracking at all levels; and misinterpretation or limited understanding of the meaning, employment, and restrictions associated with specific control measures are the primary causes of fratricide.

During October 1991 OCIT asked a group of retired general officers how fratricide can be prevented. These officers broke the problem down into two areas: situational awareness and target identification (TI). In contrast to situational awareness, target identification is defined as accurate, dependable, through-sight discrimination between friend and foe. A positive identification capability out to the maximum range of weapon and target acquisition systems is necessary. The positive identification technique or capability should result in no increase in friendly vulnerability or degradation of systems' performance.

Current systems of identification and identification training are being improved. The Army has developed a standardized vehicle marking system. Additionally, simulator graphics and training devices are undergoing improvements that will teach our soldiers and Marines to rapidly identify enemy and friendly vehicles in all types of conditions. The identification issue is a particular concern in the era of small wars we are entering where the opposition may operate NATO-type equipment and our allies

may have Warsaw Pact equipment. The DoD developed a time line to better define service expectations for the development and fielding of equipment. The time line has been broken down into the following phases: Quick Fix, Quick Fix Plus, Near Term solutions, and Mid/Far Term solutions.

Equipment that falls into the Quick Fix category is already available and in the military inventory. An example is the VS-17 panel, a bright orange cloth used for marking landing zones. A group of these panels can be seen through optical sights from the air at a distance of eight to ten kilometers. During Desert Shield/Desert Storm, VS-17s were put on top of vehicles to identify them as friendly. Another item already in the supply system is the chemical light. Chem Lights, as they are known, are brightly colored and glow in the dark. They are used for visual identification at short ranges, usually no more than two kilometers by the unaided eye or night vision goggles. The simplest, yet least effective Quick Fix method was to paint an inverted "V" on the side, front, back, and tops of vehicles. This method was only effective during periods of good visibility.

Since these measures proved ineffective, the services jointly developed devices which could be shipped overseas in immediate support of Desert Shield/Desert Storm. The

first item developed was the BUDD light. This piece of equipment is a flashing light in the near infrared light spectrum that can be seen through night vision goggles, making possible identification of friendly forces at approximately six to eight kilometers. The next development was the DARPA light, which also requires the use of night vision goggles, allowing identification at a distance of six to eight kilometers. It was primarily designed to prevent air-to-ground target misidentification. The DARPA projects a cone of infrared light visible to spotters or forward air controllers, allowing rapid identification of vehicles as friendly. Another Quick Fix item available was thermal tape. Thermal tape could be seen by equipment operating in the far infrared spectrum of light at a distance of two Km. This tape appears cold against the hot background of a vehicle that is, or has recently been, running (thus having a warm engine). Thermal tape patterns on vehicles allow friendly forces to be identified by aircraft equipped with Forward Looking Infrared (FLIR) devices or ground equipment with thermal imagers in their sights.

The last Quick Fix solution was the employment of GPS. The GPS receiver is a very important tool. It tells users precisely where they are with relation to the battlefield. GPS uses two or more geosynchronous satellites and

preprogrammed triangulation formulas to determine a user's position. This solution was especially useful in the controlling of indirect fires, as observers and firing agencies could precisely identify their locations. The use of GPS resulted in a more effective target engagement.

While these Quick-Fix solutions are improvements, they are interim at best. All but the GPS are easily exploited by a fairly unsophisticated threat. These solutions are simply short term options that can be obtained and employed by commanders.

Detailed operational requirements for future equipment have been distributed to the defense contractors via the acquisition departments of the lead services. The systems are required to be passive, non-cooperative, and non-exploitable. They will have to be operational in all weather and in limited visibility conditions. At the same time, they must be compatible with technologies used on current weapons and sensor platforms. These systems will be used by all types of combat units to positively identify friendly forces. Currently, several companies are developing systems which conceptually prevent fratricide. Many have been reviewed and several accepted for further research and development.

Systems capable of meeting these requirements will not be developed as soon as they may be needed. Therefore,

Quick Fix Plus solutions are currently being tested for fielding. GPS will be integrated, as one of these solutions, into Abrams tanks, Bradley Fighting Vehicles (BFV), and High Mobility Multi-purpose Wheeled Vehicles (HMMWV). GPS will improve the situational awareness of the vehicle commander. Also identified as a Quick Fix Plus solution is the installation of GPS equipment into other tactical vehicles. This on-board equipment will allow operators to know exactly what direction they are traveling. A thermal beacon is being developed in the Army's Night Vision Laboratory at Fort Belvoir. This device is a rotating beacon that will display a hot and cold signal only visible to a FLIR system, identifying the vehicle as friendly.

The solutions to the situational awareness and target identification problems contain many implied hurdles and additional subsystem requirements. How will information be transferred to the people that need it on a real-time basis? How will this information be retrieved or pulled by the user so that he or she is not overwhelmed with useless data? Will there be a need for a new type of information management, one capable of rapidly managing the chaos on a fluid battlefield?

Industry has been working on several methods to provide the "trigger puller," with methods of interrogating

possible targets in order to identify them as friend or foe. Currently, the most promising developments are the long-term integrated systems of intelligence and position locating that can provide everyone with an real-time battlefield display. A combination of an imbedded interrogation system using radio signalling and PLRS are technological possibilities that must be implemented to reduce fratricide during the next armed conflict.

In conjunction with these innovations, information need lines must be identified. The design of a network capable of rapid exchange of information across several subsystems and different protocols is essential. A slow or inadequate system will do more harm than good by delaying engagement time and by reporting old position locations.

Today the Army is looking into a friendly positioning system and an intelligence analysis system. Both require a network and a full time information management structure. (Full time information management structures are currently not available.) The first system is an integration of GPS with PLRS. This provides a controlling unit, a shelter-mounted computer processor which displays the location of all subscribers in the net. Each subscriber may function as a relay for all other subscribers and may also function as a way point in determining the position of others in the net. Through a process based on a polled update and signal

transmission time, positions of the transmitter are calculated by the controlling unit through triangulation from all other receivers. Each receiver is polled two or three times a minute based on the need for update. The polling update is performed via a digital VHF radio signal that contains information about the unit location and the times it received the unit's last polling transmission time. PLRS proved to be very effective during the conflict in the Persian Gulf. Now tactical system planners need to incorporate all "slugger" users into the system and then integrate it with current weapons control systems. Once this is done, the information held by the PLRS controller will be shared with the aviation and field artillery communities, which will reduce the probability of friendly fire casualities.

The second system being developed can also reduce friendly fire casualities. It is based on an intelligence analysis system. Situational awareness will be enhanced through the integration of enemy location overlays. This overlay will be provided via an intelligence system being developed by the Marine Corps and the Hughes Corporation. The Intelligence Analysis System (IAS) is a UNIX-based system which provides multi-source intelligence support to combat operations.

Enemy overlays depict aggressor positions. PLRS

provides locations of friendly forces. Therefore, commanders can position friendly units in reference to the hostile locations. The difficulty remains with the transfer of information on a timely basis to the "trigger pullers." In the future, capabilities to network information will be enhanced when both the IAS and the PLRS systems are based on Sun Workstations.

These new networked technologies will require trained nonprogramming end-users. From unit-based workstations, command level users will use pre-written software to plot friendly and enemy locations on one map overlay. Menu driven communication applications will disseminate the information. The task of the network control will be a large undertaking. Because this information will be time sensitive, it must be distributed to the user on the battlefield quickly.

These systems' architecture needs to be open. This architecture must allow for communication within several interactive systems, such as local or wide area networks. The complexity of the files and interface as well as the need for rapid responsivenes will also drive the design of the network and communication architecture.

## SUMMARY

Current doctrine and procedures, with the modifications indicated, should prove adequate in the near term, as long as all services and their leaders conform to joint doctrine. The greatest challenges lie in improving the situational awareness of all present on the battlefield and enhancing battlefield target identification.

Situational awareness reduces the potential for friendly fire by providing real-time, accurate knowledge of one's relative position in relation to other friendly locations, danger areas, enemy locations, and noncombatants. Ensuring positive target identification reduces the probability of fratricide by discriminating between friend and foe. There is an immediate need to incorporate the technological innovations being delivered by industry with doctrine, training, and procedural and technical management. Management of the advancements will require a phased approach of improving existing equipment, from selective replacement with off-the-shelf technologies to implementation of an integrated system replacement. Technology is certainly not the sole answer; the human dimension must be considered as well. Certainly the tragic and unnecessary loss of life resulting from friendly fire demands that this problem be addressed before Americans and

their allies find themselves involved in the next armed conflict.

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